

REMARKS

This paper is responsive to an Office Action mailed September 19, 2006. Prior to this response, claims 1-48 were pending. After amending claims 1-2, 11, 14-18, 25, 28, 30-32, 35, and 37-44, and canceling claims 22, 24, and 45-48, claims 1-21, 23, and 25-44 remain pending.

In Section 6 of the Office Action claims 1-48 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite. The Office Action states that the modifier “2N” is vague and contains an undefined variable. In response, claim 1 has been amended to define the “2N-shot” process. Between the amended claim recitation, and the description provided at page 6, line 10, through page 7, line 9, the Applicant submits that an expert in the art would not find the meaning of the term indefinite.

The Office Action states that claim 1 is not commensurate in scope with the preamble. In response, claim 1 has been amended to remove the phrase “grain boundary-free”.

The Office Action states that in claim 2, it is unclear whether the even numbered and odd numbered iterations refer to 2 different processes. Claim 2 states that the 2N-shot process includes a sequencing irradiation in odd and even (orthogonal) patterns. In response, claim 2 has been amended for greater clarity. Between the amended claim language and the details of orthogonal sequencing given in the specification, the Applicant respectfully submits that the claim is not indefinite.

The Office Action states that claim 3, and claims dependent from claim 3 are indefinite because they recite grain boundaries, in contradiction to the language in the preamble. The preamble of claim 1 has been amended, as noted above.

The Office Action objects to claim 11, stating that it is ambiguous if both the pattern and the substrate move together. In response, claim 11 has been amended to recite that the aperture pattern advances.

The Office Action states that claim 13 makes a selection, but does nothing with the selection. In response, the Applicant notes that claim 13 further defines a limitation (selecting a second area) initially presented in claim 11. The consequences of selecting the second are presented in claim 11, and need not be repeated in claim 13. With respect to claims 14 and 16-17, the Applicant has amended the “to be co-located” language for greater clarity.

The Office Action objects to the “first direction” language in claim 18. In response, the Applicant has amended claims 11 and 18 for greater clarity.

The Office Action objects to the term “projecting the first laser by a factor of one” in claims 22 and 24. In response, the Applicant notes that it is well known to use a lens to change the resolution of mask features. Fig. 3 shows a 5x demagnification lens, and submits that an expert would understand the above-quoted “factor of one” language. However, in the interest of passing the claims to issue, claims 22 and 24 have been canceled.

The Office Action objects to claims 25 and 28, stating that there is unclear how these steps relate to the steps of claims 1-3. In

response, claims 25 and 28 have been amended to more clearly recite limitations that are being added to previously recited steps.

With respect to claims 28, 32, and 35 and the energy density language, the Applicant has amended the claims for greater clarity. For example, in claim 28, the first area is annealed as a result of combining the energies of the first laser beam (the 4th density) with the first lamp (the 5th density).

The Office Action states that claims 30 and 31 appear to be impossible with respect to the limitations of claims 1 and 28. The Applicant cannot understand the Examiner's concern here. Claims 1-3 introduce the use of a (first) laser to anneal a first area. Claim 28 states that the first area is annealed by a combination of the first laser and a lamp. Claims 30 and 31 just add further limitations to the lamp previously introduced in claim 28. With respect to the first area top and bottom surfaces, claims 1-3 and 28 describe a first area (but no surfaces). Claims 30 and 31 add the further limitation that the first area has top and bottom surfaces. However, the claims have been amended for greater clarity, and claim 30 has been amended to recite that the lamp is directed to the substrate underlying the first area bottom surface. Claims 37 and 38 have been amended in a similar manner.

With respect to claim 39, the claim has been amended to recite that the substrate is formed underlying the Si film, and that the transistor is formed in the first and second areas after the annealing of the Si film. Claim 39 has also been amended to recite that the channel length is oriented in the first direction.

Claim 40 was amended to address the "pair of first (second) plurality" issues raised in the Office Action. As noted earlier, claim 1 has

been amended to remove the “grain boundary” language in the preamble.

Claims 41-44 have been similarly amended.

Claims 45-48 have been canceled.

In Section 7 of the Office Action objections are made to claims 3-48. Claim 1 has been amended to remove the “grain boundary” language from the preamble. Claim 18 has also been amended.

In Section 8 of the Office Action, objections are made to Fig. 4. Figs. 4a-4i are an example of the $2N$ -shot process, where $N = 2$. When $N = 2$, the $2N$ -shot process irradiates with 2 shots in the x direction, followed by 2 shots in the y (orthogonal) direction. Beginning with an amorphous film in Fig. 4a, a first 2-shot process (step) is shown in Figs. 4b-4e. The film is irradiated a first time in the x-direction (Fig. 4b) and a second time in the x-direction (Fig. 4d). The second step in the 2-shot process (in the y-direction) is shown in Figs. 4f-4i. The film is irradiated a first time in the y-direction (Fig. 4f) and a second time in the y-direction (Fig. 4h). Fig. 4i is the end result.

In Section 10 of the Office Action, claim 1 has been rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 11 of the Office Action, claim 1 has been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 12 of the Office Action, claims 1-10 have been rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 13 of the Office Action, claim 1 has been rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 14 of the Office Action, claim 1 has been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 15 of the Office Action, claims 1-44 have been rejected on the grounds of nonstatutory obviousness-type double patenting, citing Moriguchi et al. (US 6,939,754), in view of Fukunaga et al. (US 2004/0142543) or Kawasaki et al. (US 6,653,657). In response, a Terminal Disclaimer is enclosed to remove the Moriguchi reference (US 6,939,754). Therefore, even if Fukunaga or Kawasaki disclose metal catalysts, the combination of references does not disclose a 2N-shot laser annealing process, and the Applicant requests that the rejection be removed.

In Section 16, the Applicant interprets the Office Action to read that Yamazaki (US 7,001,829) or Mackawa may be used to replace Fukunaga or Kawasaki in the rejection of Section 15. However, without the Moriguchi reference, the combination of Yamazaki and/or Mackawa still does not teach a 2N-shot process, and the Applicant requests that the rejection be removed.

In Section 17 of the Office Action, claims 1-10 have been rejected on the grounds of nonstatutory obviousness-type double patenting. In response, a Terminal Disclaimer is enclosed.

In Section 18 of the Office Action, claim 1 has been rejected on the grounds of nonstatutory obviousness-type double patenting with respect to Voutsas (US 6,686,978), in view of Fukunaga. In response, a

Terminal Disclaimer is enclosed. The Fukunaga reference is not sufficient to find the claimed invention obvious, and the Applicants requests that the rejection be withdrawn.

In Section 20 of the Office Action claim 1 has been rejected under 35 U.S.C. 102(e) as anticipated by Sano et al. (“Sano”; US 6,767,773). The Office Action states that Sano’s process in reference #3 is described by the Applicant’s 2N-shot process.

Sano describes a Si annealing process that uses a CW laser that is scanned in parallel in the longitudinal direction (col. 7, ln. 56-60). Applicant’s claim 1, as amended, recites a 2N-shot process “where the film is exposed to a series of 2-shot laser irradiation steps in orthogonal directions, and where “N” is the number of steps in the series”.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Sano does not describe laser irradiation steps in orthogonal directions and, therefore, does not describe every limitation of claim 1. Since Sano does not explicitly describe every limitation of claim 1, the Applicant respectfully requests that the rejection be removed.

In Section 21 of the Office Action, claim 1 has been rejected under 35 U.S.C. 102(e) as anticipated by Fukunaga. The Office Action states that Fukunaga describes a 2N-shot laser annealing process in paragraphs [0089], [0111], and [0128-130]. This rejection is traversed as follows.

In paragraph [0089] and [0111], Fukunaga discloses a KrF excimer laser. Paragraphs [0129-0130] describe the laser beam as

traveling in a leftward direction (on the drawing sheet). Fukunaga does not describe laser irradiation steps in orthogonal directions and, therefore, does not describe every limitation of claim 1. Since Fukunaga does not explicitly describe every limitation of claim 1, the Applicant respectfully requests that the rejection be removed.

In Section 22 of the Office Action claim 1 has been rejected under 35 U.S.C. 103(a) as unpatentable with respect to Yamazaki et al. (“Yamazaki”: US 5,894,137) in view of Fukunaga or Kawasaki. The Office Action acknowledges that Yamazaki differs from the claimed invention, in that he uses a thermal process to promote polycrystallization. The Office Action states that it is well known to use catalysts to promote crystallization, and that it would have been obvious to use Yamazaki’s apertures to produce polycrystalline regions. This rejection is traversed as follows.

Yamazaki briefly discloses the use of a laser for the purpose of annealing in his discussion of the third and fifth embodiments. Fukunaga and Kawasaki are presented for their discussion of catalytic agents. Even if an expert in the art would be motivated to combine these references, the combination does not explicitly disclose either a 2N-shot process, or a directional solidification (DS) laser annealing process, as recited in Applicant’s claim 1. A *prima facie* case has not been presented in the Office Action that an expert in the art would have been motivated to combine these references. Neither has any evidence been presented in the Office Action that Fukunaga or Kawasaki suggests any modification to Yamazaki that would make these missing limitations obvious. Since the combination of references neither explicitly discloses nor suggests all the

limitations of claim 1, the Applicant requests that the rejection be removed.

In Section 24 of the Office Action, claim 1 has been rejected under 35 U.S.C. 102(e) as anticipated by Sposili et al. (“Sposili”; US 6,577,380). The Office Action states that Sposili describes a sequential lateral solidification (SLS) process. This rejection is traversed as follows.

Sposili discloses a SLS process. This disclosure is primarily concerned with the annealing apparatus. Sposili states that “details of the transition schedule are specific to the particular process being conducted and will not be elaborated here.” Sposili does not disclose the 2N-shot process recited in Applicant’s claim 1. Since Sposili does not explicitly describe every limitation of claim 1, he cannot anticipate, and the Applicant request that the rejection be removed.

Section 24 of the Office Action states that claims 2-10 are rejected under 35 U.S.C. 103(a) as unpatentable with respect to Sposili. As noted above, Sposili does not disclose a 2N-shot process. Neither does Sposili suggest any modification to his SLS process that might make the 2N-shot process of claim 1 obvious. For example, Sposili does not suggest any advantages that might be obtained by using a process that sequences laser shots in orthogonal directions. The Office Action has presented no *prima facie* evidence that an expert would have been motivated to make modifications to Sposili’s process that might suggest the 2N-shot process of claim 1. Claims 2-10, dependent from claim 1, enjoy the same distinctions from the cited prior art, and the Applicant requests that the rejection be removed.

In Section 25 of the Office Action, claims 11-45 have been rejected under 35 U.S.C. 103(a) as unpatentable with respect to Sposili in

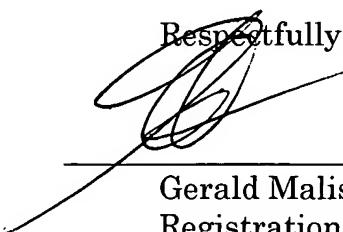
view of Yamazaki, and Fukunaga or Kawasaki. As noted above in response to the rejection presented in Sections 22-24 of the Office Action, even if an expert in the art would be motivated to combine there references, the combination does not explicitly disclose either a 2N-shot process, or a directional solidification (DS) laser annealing process, as recited in Applicant's claim 1. Neither has any evidence been presented in the Office Action that Fukunaga/Kawasaki or Yamazaki suggests any modification to Sposili that would make these missing limitations obvious. The combination of references neither explicitly discloses nor suggests all the limitations of claim 1. Claims 11-45, dependent from claim 1, enjoy the same distinctions from the cited prior art, and the Applicant requests that the rejection be removed.

In Section 26 of the Office Action, claim 1 has been rejected under 35 U.S.C. 102(b) as anticipated by Moon (US 6,113,689), or Yang (US 2001/0019863), or Kasahara (US 6,358,766). As acknowledged in the Office Action, all of the above-mentioned references mention lateral solidification. However, none of the references explicitly disclose a 2N-shot process, and the Applicant requests that the rejection be withdrawn.

It is believed that the application is in condition for allowance and reconsideration is earnestly solicited.

Respectfully submitted,

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